



K. Wolf (C. r.) Baron

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# DISCOVERY

OF THE

## TRUE CAUSE

OF THE WONDERFUL

MULTIPLICATION of CORN;

WITH SOME

GENERAL REMARKS

Upon the Nature of

TREES and PLANTS.

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*By Dr. WOLFIUS, Member of the Royal Societies of  
London and Berlin, and Professor of Mathematicks  
at the University of Marbourg.*

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DISCOVERY

OF THE

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By W. B. ...  
London ...  
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# THE PREFACE.



NOT all that delight in Truth, have the same Views: Some mind nothing but speculative Sciences and the Productions of rare Wits, either to gain themselves Applause, or because they find a particular Pleasure in them: Others on the contrary will not value an Invention any further than it influences and promotes the Happiness of human Life. The Understanding of the latter is generally of a very narrow Compass; whence it proceeds that they despise every Thing as Trifles and Whimsies that they cannot penetrate into, and where an Advantage is not immediately and manifestly shewn. So on the other Hand those Sciences, which are indeed of a certain Use in human Society, yet do not require Depth of Study, are look'd upon by great Scholars as mere Arts to get a Livelihood by. As for my own Part, I am the more pleased with a Truth, the deeper the Notions of it are, but I esteem it still the more, the more advantageous it



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proves to the Commonwealth. Truths of the former Kind demonstrate the Perfection of the human Intellect, not only in the Inventor, but in him also that's able to apprehend them: very often they shew likewise hidden Perfections in the Thing it self. Why should they not therefore cause Matter of great Pleasure to a reasonable Man, all Pleasure consisting in the Sense of Perfection? Truths of the latter Sort, and where the common Good is concern'd, are more needful than the former that give but a private Pleasure. For, to examine the Thing narrowly, the Reason of our making much of a Truth, that gives Pleasure, is, because we consider this Pleasure as a Part of human Happiness: Who therefore can take it amiss, that a Man makes more Account of a Thing that is needful, than of another that is less so? I am used to compare those Arts, which the Society of Mankind has extreamly need of, to Bread, and the others to Diamonds. He that is not possessed of more than what pays for his daily Bread, does well not to care for Jewels, but a wealthy Man may purchase rich Stones to charm his Eyes and Mind with. However, it behoves us to judge of the Use a Truth may be of, with a great deal of Discretion; for sometimes it must be far fetched, but is of great Importance when found out. It must be said in Praise of the Academies of Sciences, that they have successfully endeavoured hitherto, to set in a clear Light Things of uncommon Penetration! But I wonder that there are not also Academies erected yet, whose Business it would be to enquire into Truths, which might advance the Welfare of Society. The learned Members or Fellows of those Academies have explained hitherto nothing else but Parts of Mathematicks, Astronomy, natural

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ral Philosophy and Physick, or generally Things of a sublime Nature: But none or very few of them have undertaken to consider either Virtue, or the Art of Government, or Matters of Husbandry, and many other Things relating thereto, the solid Examination whereof demands as much Penetration as Geometry does. I don't think that there is no Occasion for a better Enquiry into these Things, and that it is sufficiently known what may procure an Advantage to the Publick, or that it is at least easily to be discovered when Occasion does offer; For Experience shews the contrary. I have made it evident in the following Piece, that a great many Things might be improved in Husbandry. It is plainly proved not only by good Arguments, but by infallible Experiments too, that every Grain of Seed is endowed with an infinite Faculty, continually to produce Ears and Grains, and to yield some thousand-fold Fruits according to the present Nature of Things. I have made it appear very probable, that a much more advantageous Manure might be made Use of than what has been used hitherto. Lastly, it is observed, that till now nothing has been known of the true Nature of Blasts in Corn, and that accordingly all Remedies in that Case must have proved fruitless. But such Enquiries cannot be made without a Skill in natural Things, an Exercise in Experiments, Observations and Reflections, as every Body may see that will fix a little Attention upon the present Work. Nay, if any one would practise the Maxims I have given, in Agriculture, he must without Doubt apply himself to Mathematicks: Therefore Enquiries of this Nature belong to Academies of Sciences, whose Business it is to enquire into Truths unknown. I could



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could enlarge upon a great many Things more about Husbandry and Gardening if I was not persuaded that every Body will be sensible of them. I shall but instance one Thing more: Those that are entrusted with the Care of the Estates of Princes cannot be blamed if they make but shift to improve the Rents of them, this being their Duty.

But if we consider their Proceedings we find that they make Use of quite wrong Ways and Means. For their Cunning consists in enriching the Prince with the Property of the Subject, under Pretence of Right; whereas it has been most evidently proved along while ago, that a Prince cannot be reckon'd rich, but when the Coffers of his Subjects are well filled. He therefore that will enrich his Prince, must find out a Way that the Subject may gain and save more. Now all the Acquisitions of Treatises consisting in Husbandry, Trade, and Handy-work, the Advancement of those Things must be the chief Care of a Minister. But many usefull Problems are obvious in these Things, which are not to be solved but by him that is versed in Mathematicks and natural Philosophy, and that has made it his Business to reflect upon Things. Accordingly they ought to be Part of the Occupations of those Societies of learned Men; or Princes ought to have at least some among their Officers that are capable of solving Problems serviceable to the Publick. This is the chief End of my own Labours too, agreeable to which I endeavour to set useful Sciences upon such a Footing, as may enable Mankind to go about so salutary a Work. To this End I do not rest satisfied with the Explication of any natural Things that are not made evident by undoubted Experience, nor mind any poor Fictions by which some fancy to drive in-  
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to the Bottom of Nature: Witness these few Meditations. As for other Sciences, I try no less to give them all possible Certainty and Perspicuity, and to adjust them to the Happiness of human Society, and I don't doubt but that Success will answer my Labour when I have Time to collect the Reflections which I have for some Time propos'd in my Lectures. As to the rest, concerning this little Treatise, my Design is to illustrate Husbandry and Gardening, and to encourage others by these Means, to meditate upon natural Phenomena's. To this Purpose, I have amply talk'd of the Opportunity I have had to think on the present Subject, and of my Method in reasoning and making of Experiments, till I came to know at last what I aim'd at. By this any Body may see how he must go to work to come at a due Knowledge of the Faculties of Nature. I have referr'd here and there to my *Reflections about the Faculties of the human Understanding and their right Application in the Knowledge of Truth*, for to shew, that the Rules I have settl'd therein, do as much Service in Matters of Reasoning, as possibly may be expected from Rules. For Rules indicate only what is to be done, but don't qualify you to put Things into Practice, which is to be obtained only by frequently employing the Faculties of the Intellect. I flatter my self not to have said too much when I say that I have illustrated Husbandry and Gardening. For, supported by my Invention, one may account for a great many Things belonging thereto, which there was formerly no accounting for at all. But I am the first that has made an Essay to give Husbandry and Gardening a Form of Science. The Subject itself has indeed been treated at large and successfully by many Authors, but none of them having a thorough



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thorough Insight into Nature, have try'd to make good their Rules by the Means of a thorough Knowledge of Nature. But this will be facilitated if but what I have begun is carry'd on. I shall not fail to contribute towards it my self, if God is pleased to grant me Life and Health, and Opportunity is given me; nor shall I for want of this, be unwilling to assist others, to whom it is offer'd with my good Advice.



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A  
DISCOVERY  
OF THE  
Multiplication of Corn.

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CHAP. I.

*Of the Occasion of these Considerations.*

§. I.



I were to be wished that those Gentlemen, who by their new Inventions improve the Arts and Sciences, would be pleased at the same time, truly to communicate to the Reader what first gave rise to their Discoveries. For by this, many a Reader would be encouraged to meditate himself upon things, who is contented either to keep only in his Memory the Inventions of another, or at the best to enquire only into the Truth of 'em.

B

§. 2.



§. 2. It has always been my Endeavour to be of some use to my Fellow-Creatures, and I find my self obliged to acquaint them, not only with the Method I have taken, to find out the true Reason of that prodigious Multiplication in Corn, but also with the occasion I had. In treating of this present Subject, I shall begin with the Latter, namely, the Occasion of these my Enquiries.

§. 3. A Book of the French Abbot *Vallemont* which he entituled, *Curiositez de la Nature & de l'Art sur la Vegetation, ou l'Agriculture & de Jardinage dans leur perfection.* 1708. Gave me the curiosity to read it, in order to know the Mysteries he promises in the Title Page, to reveal.

§. 4. The first of the Curiosities he proposes is the Multiplication of Corn, treated of at length in the 6th and 7th Chapter. I soon fixed a particular Attention upon the 6th Chapter, finding no great Advantage in the foregoing Chapters, where the Author only exposes at large the Pleasures of a Country Life, with an Anatomy of Plants.

§. 5. Having finished the reading of it, I saw that the Author's Treatise might be reduced to three Heads. I found that he told us in the first place, how that a great many Corn-ears had actually grown out of a single Grain. I found in the second place some ways and means, how to effect this always by Art; and in the third place, the Author's and others Opinion about the Cause of this Effect.

§. 6. I chose to begin with the reading of the first Head for the following Reasons. I love Truth above all Things; but I remembered to have met with more Truth in those Books, that give us an  
Account

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Account of natural Effects, than I have met with in those, that pretend to determine the Causes of them. Nature is not to be studied by ruminating at home, we must always begin our reflections with an exact Experiment, unless we have a mind to be imposed upon by mere imagination. Notwithstanding therefore the Author's not observing any order in his Account, I pickt up first of all the historical passages, that prove the Multiplication of Corn to be Matter of Fact.

§. 7. The first Instance he cites, is taken out of the *Ephemerides Naturæ Curiosorum*, 1671. which tells us of an extraordinary large Barley Ear, consisting of 15 large, and 9 little Ears, all filled with Corn, that came forth in *Silesia*. Our Author observes, that some Natural Philosophers believed, that this Ear was not grown out of a single, but more little Grains accidentally fallen together; however he takes this Explication to be unnecessary, knowing by Experience, that one single Grain of Corn or Hemp, produces a Plant that spreads very far, in a garden of a fruitful Soil.

§. 8. The Author takes Notice afterwards Page 184. of Mr. *Denis*, Phyician to the King of *France*, who by his reiterated Experiment, has drawn above 200 Ears out of one single Grain.

§. 9. He assures Page 187. that the *Fathers of the Christian Doctrine* at *Paris*, are possessed of a Cluster of Barley that holds 249 Ears, and above 18000 Corns, all sprouted forth out of a single little Grain.

§. 10. He mentions Page 196. out of *Monconys* Travels, that a certain *English* Nobleman ordered his Corn to be clipt when it was green, and ob-



tained thereby, that every single Root produced near a Hundred Ears.

§. 11. Lastly. the Author relates some Instances C. VII. p. 208. & seq. that Mr. *Dodart*, a Physician at *Paris* had recorded in the *Memoirs of the Royal Academy of Sciences*, 1700. This Gentleman has had in his Hands two Clusters, one of which held above 100, and the other above 60 Ears. He has seen besides that, at the President *Tambonneau's* two Clusters of Wheat, one of them having 32 Halms, each of 'em with 10 Ears, and each Ear filled with 30 Grains, except the middlemost Ear, which held 36. According to this, one single Cluster consisted of 320 Ears with 9792 Grains. But when I conferred my self to *The Memoirs of the Royal Academy of Sciences*, with what this Gentleman observes, I found in Page m. 203, 204, that M. *Dodart* has not been sure of all those Ears growing out of a single Grain, but that he doubted, whether the Roots of more Grains laying one near the other, were not grown together.

§. 12. Upon the same account I remained yet uncertain, whether ever many Ears were produced by one single Corn; not meeting with all the Circumstances that are required for one to rely on another's Experience.

§. 13. And whereas we must not proceed to enquire into the Causes of a natural Effect, before we are assured of its Existence; I thought it fit to make first an Experiment with some Grains, to the end that I might see if they would produce more than one Ear, when put into a good Garden Ground.

§. 14. The principal Way our Abbot shews for the Multiplication of Corn, is, to lay the Grains a foking in a Bog, or Water that has Salt-petre in it, before they are cast upon the Field.

§. 15. I think it improper to mention here all the Author's Methods to lay the Corn a foking; it will be sufficient to observe, that the Salt-petre is to be melted in seething Bogwater, to which may be added rain Water, wherein Horns or Claws of Beasts, Leather, Feathers or Bones have lain putrifying, and that the Corn must swell up in it, and afterwards be aired a little, before it is sown.

§. 16. Because daily Experience shews, that Dung, Corn, and rain Water is of great Advantage to a Soil, and because it has been thought of old, that Salt-petre likewise does it a great deal of good, which *Virgil. Georg. l. 1.* and *Columella de Re Rust.* confirms, who tells us, that formerly the Husbandmen were used to make their Seed fruitful by Salt-petre; I found no reason absolutely to deny, that the foking of Corn does not make it fruitful. But I could not believe it neither as unquestionable, not being yet certain, whether Nature produced more than one Ear out of one single Corn, (§. 12.) and though that might be; whether in a good Soil many Ears could not grow out of one Grain, without its having lain a foking, Nay, because our Author himself is sure of the first, (§. 7.) I could not look upon the foking any more than upon the dunging of the Land, and consequently not take it for the only means to bring forth many Ears out of one Grain.

§. 17. This therefore gave me still a greater Curiosity to make an Experiment with some Grains.

§. 18.



§. 18. Lastly, as for what concerns the Cause of many Ears growing out of a single Corn, that has lain a sowing, I found our Abbot's Opinion of it in the beginning of the 7th Chapter. He takes to be true what some modern Philosophers have advanced, and what particularly Mr. *Malebranche* endeavours to demonstrate in his *Recherche de la Verité* T. 1. B. 1. C. 1. p. m. 38. *seq.* that all those Ears which in a thousand and more Years grow successively out of one grain, do exist in that very grain perfectly formed, be they never so little. According to this opinion, there lies concealed in that single Grain, which this Year is thrown into the Earth, the perfect Stalk with the Ear and all its grains. Moreover there is all the Ears in it, that grow out of these Grains the ensuing Year; also all the Ears that grow out of the Grains of the second Year, in the third Year; no less the Ears that sprout forth in the fourth Year out of the Grains of the third, and so further *in infinitum*. Therefore our Author thinks, that those Grains might be brought forth in one Year, which Nature does by Degrees in more Years, in case she is assisted by the sowing of the Seed, and that the Salt-petre forces out besides the principal Stalk some others, that would not gain strength but the ensuing Years. Nay, because he has perhaps called to mind *Dodart's* seeing many Ears upon one Halm, (§. 11.) he adds moreover, that the capital Halm contains an infinite Number of Ears, that comes only to their full growth in following Ears, unless that many of them are expelled in one Year by the force of Salt-petre and the saltish Particles, they have been sowing in.

§. 19. I don't doubt in the least, but that a great many

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many are of our Abbot's opinion; for I see the same Method of reasoning and explaining natural Effects in most of our modern Books about Subjects of Natural Philosophy. But as for my own part, I must confess, that when I examined the Argument a little, I found it quite destitute of any Foundation.

§. 20. I could not see in the very beginning, how from the Petition of some modern Philosophers, that, namely in the first Grain of Corn, all these little Grains lye buried, that have grown out of it from the beginning of the World to this present time, and that will grow out of it, to the end of the World. How, I say, our Abbot could infer this Consequence, that therefore one Year would bring forth, what commonly is to be unfolded by many Years. It seems that he has not considered the manner of many Ears being one in another, according to these Philosophers. The Case is thus: In the first Grain of Seed there is but one shooting, wherein they pretend, the whole Halm with all the Grains of the Ear lyes, and grows out of it, in case the Grain is thrown into the Earth. Each of these Grains holds a new Shooting resembling the first, and each Grain of it holds new ones again. Therefore the Ears of the second Year cannot come forth, before the Grains of the first Ear are become ripe; also the Ears of the third Year cannot grow till the Grains of the second have ripened, &c. But if you would bring forth in one Year, what should grow in three or more Years, you must render it possible for one to sow, and have a Crop three or more times in one Year.

§. 21. It is not difficult to find the reason, why  
the



the Ears of the following Year cannot anticipate the Maturity of those of the foregoing. For if a thing has in it many of its own kind, one must be smaller than the other. If therefore the one Shooting of a Corn contains more within it self, the Shooting of the second Year cannot but be smaller than that of the first, and the Shootings of the third Year must be yet smaller, than those of the second, &c. So that, because Nature makes no sudden Starts, but proceeds orderly tho' insensibly, those Ears that are far from being unfolded, and have unequal Degrees of perfection to go through, before they come to a visible growth, cannot come forth in the same time.

§. 22. I don't doubt but that it will be alledg'd against me, that our Abbot does not admit of innumerable Ears being in one Corn, as I conceive it. But I pretend to shew the contrary. For in the beginning of the VIIth Chap. pag. 200. he expressly affirms, that the whole Art of augmenting of Corn consists in forcing out by Art in one Year, what otherwise would be the product of three or four Years. Now there remains of the Growth of the first Grain nothing but new Seed, which may produce new Ear again in the next Year; also of the growth of the second Year there is nothing subsisting but Grains that are the Seed of the third Year's Ears, &c. Wherefore if in the first Year there is forced out by Art, what commonly does not come forth but in the second, third or fourth Year, the shootings out of the Seed of Corn of the first, second and third Year are to grow altogether out of the first Corn Seed, by which a Confusion in Nature is unavoidable.

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§. 23. However I was willing to believe that this might have been said, by our Abbot's not being attentive to the manner he expressed himself in, and that it was his true Opinion, that there was in one single Grain more Halms besides the capital Halm, which being lost by the natural way, might be unfolded altogether, provided there was no want of means for it. But I found as much difficulty here as before. For as soon as the Leaf of the capital Halm sprouts forth and takes Root, there remains nothing of the Grain of Seed but an Husk, consequently no new Halm is to be drawn out of it. I cannot say neither that a prepared Grain of Seed shoots out as much, as there grow Ears out of it, because, as I have seen afterwards; this is not only contrary to Experience, but it is also impossible that those Halms, which are far more imperfect than the capital Halms, can shoot out and grow up equally with them.

§. 24. Having thus reflected on the great Benefit it would be to human Life, and to the better Understanding of Natural Philosophy, if we were certain of a great Number of Ears growing out of one single Grain, and of the Causes of it; I took at last the Resolution to enquire into the matter myself, and I flatter my self that I have found out what I searched after, it being evident by repeated Experiments.



C

CHAP.



## C H A P. II.

*Of the true Cause of that prodigious Multiplication in Corn, and of the Method by which it has been discovered.*

§. 1. **I** was resolved to try first by way of Experiment, if many Ears would grow out of a single Grain, (§. 13. 17. c. 1.) and in case it should happen so, to enquire into the Cause of it, (§. 24. c. 2.)

§. 2. The next Summer therefore, *Anno* 1709. I put two Grains of Oats into the Earth, in a place exposed to the Sun all the Day long, where I knew that any thing would grow better and sooner, than in any other part of the Garden. My chief Reason for it was, that the Corn in the Fields has the benefit of a constant Sun-shine. I did not water the place, but was contented with the Rain and Dew that fell, tho' it was a very dry Season.

§. 3. To the end that I might know, whether the Grain would grow with more than one shooting out, and that I might be able to refute such as had imputed the multiplication of Corn to a wrong Cause, (§. 23. c. 1.) I looked every Day after it; but I found what I expected, *viz.* that each Grain sprouted forth no more than one Leaf, as it commonly does in the Fields.

§. 4. My Design at that time was to attend no more to it, but to let it grow amongst the *Cockle* weeds.

§. 5. When I looked at my Hahms some time after, I saw with great delight, that each of my Grains

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II

Grains had brought forth a whole Cluster, but was very desirous to know, what would become of the Fruit.

§. 6. Harvest being come, I met with a great many Ears brought forth by a single Grain, each of which having a particular Halm of extraordinary Length. The Ears were altogether filled up with Corn, tho' not generally ripe. I observed that the Grains were longer and thinner, than what those of Oats in the Fields usually are. However, trying the Weight of 'em together with some of the best Oats of the Field with great exactness, I found them considerably heavier.

§. 7. I then counted all the Ears and Grains; I measured the Halms exactly by the Royal *Parisian* Foot, and determined the proportion of the Weight of the Grains to the Oats in the Field by repeated Experiments. But I cannot be more circumstantial in this, having lost the Paper that I wrote it down upon.

§. 8. But this I remember very well, that when I plucked one of the Clusters to pieces, I saw each Halm have his own Root. The Halms were easily to be parted from one another, and it seemed as if only the Roots were grown together.

§. 9. I left the other Cluster in the Ground, at the lower part of which new Halms were coming forth, when it had rained after the Harvest, which shot out into Ears about *Michaelmas*. Moreover, some Rain falling soon after *Michaelmas*, new Halms below were growing again, so that Seed-time and Harvest came in at once.

§. 10. By this I was sufficiently convinced, that one single Grain might produce a great many Ears, that yet for all this each Grain has no more than one Shooting, that the capital Halm comes forth



out of this Shooting, but that the By-shoots proceed from some where else.

§. 11. Thus Experience confirmed, what my own Meditation furnished me with against the common Explication of the Cause of Multiplication in Corn, (§. 23. c. 1.) and therefore the soking of Corn lost a good deal of Credit with me, tho' I shall tell my Reason elsewhere, why I cannot wholly reject it as yet.

§. 12. Now I was assured too, that it would not be amiss to examine into the Causes of more Ears growing out of a single Grain. I knew that there was nothing in the Grain but the capital Halm, and that the rest of the Substance in the Grain of Corn was for its nourishment, before it can get any from the Ground by the Root.

§. 13. The By-halms therefore not growing immediately out of the Grain, they sprout forth either out of the Root or capital Halm.

§. 14. Agreeably to a manner of an Idea's arising in the human Mind, which I shall treat of at length in my next *Meditations upon God and the Soul of Men*, I knew, that when we are to treat of any speculative Matter, the first Idea always begins either with the Contemplation of the thing it self, or of the signs by which it is represented to the Mind.

§. 15. When I represented to my self the Cluster of Oars, just as I saw it stand in the Garden, I remember'd that all the Ears were grown out of the Earth. When I represented to my self again the Condition the Cluster was in after being pulled out of the Ground, it put me in mind, that indeed every Cluster had its own Root, but that nevertheless the Roots were grown altogether.

§. 16. Experience shews, that not only the EXTRAORDINARY SHOOTINGS come forth out of the  
Roots

Roots of Trees, and that every By-shoot may become a Tree, but that also many foreign and domestic Plants bring forth such By-shoots out of their Root, and by this propagate their Kind. An instance of outlandish Plants is the *Jucca gloriosa*, the *Aloë's* Plant, the *Skrubjesmin*. An instance of domestic Plants is *Balm-mint*, *Nettle*, *Sallet-herb*, *Skirret*, &c.

§. 17. I was sure that as to those Plants that have their Growth from the Root, the Roots spread out sideways, but the Root of my Cluster of Oats was of a very little compass, and consisted of but small Fibres. The By-halms therefore could not possibly come out of the Root.

§. 18. So there remained nothing but the Halm that had produced 'em, tho' I observed that not all the By-halms could have grown out of the principal Halm, because they were not all fastened thereon; but that always one By-halm must produce another.

§. 19. I grew curious to know, how a Halm could produce a By-halm. Representing the Halm to my Thoughts (§. 14. c. 2.) I observed several Eyes or little Buttons upon it, and remembered that the Stalk was hollow and empty, that there was no Pith but in the Eyes, and besides that there was no Eye, but where there was a Leaf.

§. 20. Here I remembered that not only in Trees the Buttons which produce Boughs, grow where there is a Leaf, but that also in other Plants By-stalks come forth with the Blossom where a Leaf fits. An Instance is the *American* Flower of the Sun, which after the Flower of the capital Stalk is decayed, yet throws out By-stalks with Flowers, at every place where is a fresh Leaf. I thought also of my Method of bringing up *Marjerom*, *Sage*, *Balm-Mint*, *Balm-gentle*, viz. As soon as I observed that



that the first Stalk by the lower Leaves began to put forth Leaves afresh, I clipt it to two Leaves, and in a few Days I obtained two By-stalks. When these sprung out again, I cut 'em to two Leaves each, and some Days after there grew four Stalks, in the room of which I had afterwards eight, sixteen, &c.

§. 21. This made me conclude, that therefore no By-halm could have sprung out of the Halm of Oats, except there was a Leaf, and that this By-halm had taken its particular Root in the Ground.

§. 22. Now I was sensible, that it was possible to get a great quantity of Ears out of a single Grain of Corn, *viz.* Because the Grain has no more than one Shooting, therefore but one Halm with a single Ear can grow out of it. But in case one or two Leaves that are the nighest to the Root have the Buttons of the Halm, they are fastned on in the Earth, or near to it; then these Buttons take Root, and a By-halm shouts out of the Pith. The capital Halm stands upon the horizontal superficies according to a Plumb-line, and the By-halms must have the same stand, and consequently grow up parallel to the capital Halm. For this reason the By-halm must first decline a little from the capital Halm. That is the reason why the By-halm trails along the Ground one or two Buttons, and that two new ones always can grow forth out of each By-halm, as long as there is no want either of sufficient nourishment, or of Rain-water and Dung.



C H A P. III.

*Shewing, how the Cause of the Multiplication in Corn has been made good by Experiment.*

§. 1. **I** love to see any discovered Truth in Natural Philosophy confirmed by undoubted Experiments. For I delight in knowing a thing to be actually Truth, that appeared so to me in my Meditation. The second Reckonings that we are used to make in Arithmetic, inspired me with this taste for Experiments in every thing. For looking upon Arithmetic as a peculiar Part of the Art of Invention, and having learned Mathematicks with no other View, than to get at the Maxims of Meditation; I endeavour'd very soon to make use of the Maxims of Arithmetick in Natural Philosophy, as well as in other Sciences.

§. 2. Notwithstanding therefore that I found no reason to doubt of the truth of the Cause, I had given for the Multiplication in Corn, having taken nothing for granted but what is founded on Experience, and having proceeded as far as I could remember, orderly in my Conclusions; nevertheless I had a Fancy to make particular Experiments with the Corn, in order to assure myself the more of the truth, as well as others, especially such as have little or no Skill in Reasoning.

§. 3. When I considered then, how I ought to proceed in this Experiment, I remembered, (§. 22. c. 2.) that, *First*, I was to put the Grains a little deep into the Ground, at least so far that a couple  
of



of Buttons of the Halm remained under the Earth, and that I was to observe besides this, whether the By-halm would constantly shoot out betwixt a Leaf and the capital Halm. I found, *Secondly*, that it would be proper to lay into the Ground one or two of those Buttons that are over it, before they grew hard, to the end that I might see, whether they would take Root and throw out a new By-halm. *Thirdly*, That it would be no less Advantageous to dissect carefully a ripe Cluster, to see, how far the lower Buttons of the Halm are off from the Root, and if one Halm was grown on the other near the Button. *Fourthly*, That I was to observe, if after the Harvest a new Seed might not still be produced; and if, *Fifthly*, this Seed could be kept throughout all the Winter, and Fruits be gathered from it the next Year, that at last, *Sixthly*, I was to number the Grains and Ears, to see the Degree of this Multiplication.

§. 4. I formed this Design as Winter was coming on, and when it consequently could not be executed. Other Business afterwards hindered me from thinking of it, till the Season was too far advanced again, and I was like to have left it quite off, had I not been encouraged to go on with it by Baron Leibnitz.

§. 5. I had acquainted this great Man with my Invention, which he finding to be of consequence, accordingly advised me in his Answer not to lay aside the Enquiry of it, and repeated his Instances when I had afterwards the Honour of a Visit from him at *Hall*.

§. 6. I ordered therefore at the beginning of the Spring 1716, a Case to be made for me, and to be filled with Earth out of the Garden. Then I put into it a Grain of Barley and another of Oats,  
kept

kept the Box within my Bedchamber, and did not set it at the open Window, but during the Day-time. Because neither Dew nor Rain could fall upon it, I watered the Earth only with Pump-water, except once or twice with some Rain-water that I had caught.

§. 7. The Oats as well as the Barley, came forth with one single Leaf. When the second Leaf came out, the By-halm began to shoot up betwixt both. I saw the same afterwards betwixt the second and third Leaf. In time the By-halms brought also forth other Halms.

§. 8. I laid some Earth about some Halms that were shot up high, the Buttons whereof were still quite green, and soft, so far however that it cover'd one Button, and when I turn'd away the Earth some Days after, I saw that Button the Leaf was grown on, was burst open, and had brought forth two Roots, tho' I could not yet discover a Leaf. I left another Button longer under the Ground, and it shot out a new Halm.

§. 9. I cannot recall exactly, how many Ears I got by this Grain, but there were not a great many of 'em. I had likewise planted some Grains in the Garden, where the Oats as well as well as the Barley, did extend itself into much larger Clusters, tho' it happened unluckily, that altogether, except one very large Cluster of Oats, which was made up of some good and some blasted Ears, were pull'd out along with the Weeds, and so consequently were of no Service to my Purpose. As for the Cluster of Oats, I took it out of the Ground before any thing was ripe, in order to examine into my Discoveries about the blasted Corn, which I shall enlarge upon hereafter.

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§. 10. There



§. 10. There cannot be any other Reason of the Grains in the Box not growing, as well as in the Garden, lying in the very same Ground, and the Roots having room enough to extend themselves in; but because Pump-water gives not the Nourishment, Dew and Rain-water does. I was therefore a little vex'd, that I had got no ripe Grains in the Garden, and could not be sure of their respective Goodness by weighing one against the other.

§. 11. Parting the Cluster of Oats, the Ears whereof were partly blighted, I saw plainly, that each of this great Number of Halms grew on the Eye of the other, at the Bottom where its Root began, and that its Root had no Communication with the Root of another Halm. The like I observed afterwards in the Oats and Barley that were in the Case or Box.

§. 12. Thus far I went then in my Proceedings, but expected another Opportunity for the remaining three Articles which (§. 3.) I was to enquire into.

§. 13. And that I might clear up those too, and have an Opportunity to make good by Experiment some other things that I shall touch upon below, I put several Grains of Oats and Barley into a Place that had not been dung'd, neither this present, nor the foregoing Years: On the contrary I put some Grains of Oats into a Bed of Asparagus, which from the Beginning of the Spring had been filled up with Dirt, and had lain spread over it all the Winter long.

§. 14. All the Grains of Barley and Oats in the Ground, that had not been dung'd, brought forth considerable Clusters, especially the Oats had much larger Straw than what it has in the Fields. However the Clusters of Oats in the Bed of Asparagus were still greater, and their Ears fuller of Grains,

Grains, 'than those in the Ground that was not dung'd.

§. 15. Sometimes, as I was walking in the Garden, I pluck'd out some of the latter Halms. I had a Mind to be fully assured of all the By-halms growing out of the Eye of another Halm, and of every ones having not only his own Root, but also to shew the Justness of my Invention to some that delighted in Natural Sciences.

§. 16. When I once after the Harvest was over dissected a large Cluster of Oats in the open Fields, and in the Presence of some of my Hearers, and counted all the Grains in the Ears, I found above 6000 of great and little Grains; it being known that two Grains are always together in Oats, a large and a smaller one. But by Reason of the very dry Summer Season, there were almost as many of those Halms, that had not begun to grow till in the Dog-days, and afterwards, very little and dried up, as there were of others brought to Perfection.

§. 17. I was indeed resolv'd to count the Grains and Ears of all the Clusters that were growing in the Earth, which had had no Dung, but wanting Leisure for it, and not being easily prevail'd upon to take upon trust what is done by others in Matters of Experiment, I did it but with some of 'em.

§. 18. The first Cluster of Barley that fell into my hands, and which was one of the largest, tho' not the largest of all, held 68 Ears, for the most Part ripe, and besides 21 more, which were not come to maturity, but had been stopt in their Growth by extreme dirth.

§. 19. One of the ripe Ears had 32, another 30, five of 'em 29, one other 28, another five 27, another seven 26, another five 25, eight 24, as many  
D 2 again



again 23, six 22, nine 21, five 20, three 19, one other 17, one 16, one 13, and another besides but 9 Grains. The Sum therefore of all the Grains in the ripe Ears, was 1586.

§. 20. Wherefore, because thirty-three Ears had not less than 24, on the contrary, thirty-one Ears held not above 23 Grains, we may according to the Rules of Probability that are made use of to determine the Chance of Games, suppose 24 Grains for each of those Ears, that were hindered in their growth. For if according to the same Rules, we add 23 to 24, and part the Sum 47 in two, the Product is  $23\frac{1}{2}$ , for which we may as well put 24, because the Sum of Grains in the plentiful Ears 869 exceeds very much the Sum of Grains in the others 717, particularly because the same Sum is produced wholly, if we divide the Sum of all Grains 1586 by the Number of Ears 68. So we may reckon for those 21 Ears, that were burnt up by the excessive Heat, 504 Grains, which without any doubt would have become ripe as well as the rest, if it had not been for the aforesaid Heat of the Season. Now if we add these 504 Grains to the first 1586, the whole Sum of Grains is 2090, that one single Grain of Barley has brought forth in a good Soil, tho' not dung'd at all.

§. 21. Observe, that those Ears which had not many Grains, where not come quite to Perfection, witness the scorch'd Hulls, that one could plainly see in many of 'em, for instance in those that had 9, 13, 16 and 19 Grains. The Cause hereof was nothing else as I suppose, but the constant Dirth, want of Dung, and necessary Nourishment.

§. 22. I took out afterwards the smallest Cluster of Barley in appearance, which had no more than thirty-seven ripe, and twenty-six green Ears. Here  
it

it was plain enough to be seen, that those Ears which had 16 or 20 Grains, were dried up at the upper end, having Hulls instead of Grains, which confirm what I mention'd just now (§. 21.) about the Cause of some Ears having less Grains than others.

§. 23. One of the ripe Ears had 32, three of 'em 29, one 28, three 27, four 26, one 25, five 24, one 23, four 22, two 21, six 20, one 19, two 18, one 17, and two 16 Grains. Agreeably to this the Sum of all the ripe Grains was 854.

§. 24. One Moiety of the Ears, just as before, held not under 24, and the other Moiety not above 23 Grains, and nevertheless the Sum of Grains in the plentiful Ears 477, is considerably greater than the Sum of Grains of the other Ears 377. Therefore we may again reckon for each of those 26 Ears that could not grow ripe because of the excessive Heat, 24 Grains, consequently for the whole 624. Adding these 624 Grains to the first 854, we get a Sum of 1478 Grains, that one single Grain of Barley may produce in a very small Degree of Fertility.

§. 25. That I might experience the Quality of my Barley, I have weighed it with other Barley, and found, that notwithstanding mine was much drier than the other, 28 Grains of my Barley stood equilibrions to 31 Grains of the other Barley, in a very exact Steel-yard. If 28 Grains of my Barley had been equilibrions to 30 of the other, the proportion of the Goodness of my Barley to that of the fields would be, as 14 to 15, and consequently better about  $\frac{1}{5}$ . But 28 Grains of my Corn weighing as much as 31 others, the Difference is still greater than  $\frac{1}{5}$ .

§. 26. The Goodness of my Grains consisted in their being more solid and compact than the others.  
For



For tho' they seem'd indeed to be smaller, yet they were of more weight. And when I look'd through a Microscope upon a Slice of both Sorts of Grains, I observed that the little Lumps which they are made up of, were much smaller in my Grains than in the others. This too makes me believe, that my Grains would have made a finer Flower; for I suppose it to be known, that a Flower represents itself in a Microscope like unto a great many little Bubbles.

§. 27. The By-ears had shot out much higher than the common Barley does in the Fields. But however, there were Ears of the same Length, each having five Buttons, the Distances from one Button to the other were not equal.

§. 28. The most remarkable of all was, that a By-ear had brought forth a little Halm of near two Inches long out of the next Button to the Root, tho' it stood about an Inch from the Ground, and could not take Root; but this Halm was quite burnt up by the Heat. On the contrary, on another Ear I met with an Halm that had a good Ear, and was likewise grown out of the next Button to the Root, and yet stood above an Inch from the Ground, so consequently was not able to take Root. The Halm consisted of no more than three Buttons, tho' it was above an Ell long up to the Ear, I counted 24 ripe Grains in it, that were as heavy and solid, as ever those in the Capital Ears could be. Besides some Hulls were dried up for want of Nourishment.

§. 29. By this it is clear, that each Ear would at least bring forth one By-ear without a Root, if there was sufficient Nourishment for it, and besides makes good what has been said above (§. 11. c. 1) about many Ears being in one Halm.

§. 30. I

§. 30. I could after the same Manner enlarge upon some Clusters of Oats. But because a close Examination of 'em would be too troublesome, and that the large Account about the Barley, will make one judge of the Fertility in Oats, I won't mention every Circumstance of it.

§. 31. However, I cannot pass by without mentioning, that I left the Roots and Stubbles of some Clusters of Oats in the Ground, to see if the Stubbles of the latter By-ears that look'd green below, tho' the Ears of 'em were quite ripe, would not break out a fresh. Going into the Garden the 17th of *December* when the Weather was mild, I found new Clusters of little Halms by 'em, and a great many Shootings out.

§. 32. I don't doubt, but that if it had been Rye, or Wheat, the Seed of it could have been kept during the Winter, and would have brought forth new Fruit the next Year. Nay, I am of Opinion, that the Shootings out, that one had kept the Winter, might be dissected and laid otherwise, and so that the Shooting out would grow again into a whole Cluster. Every one will subscribe to this, who considers what has been said (§. 22. c. 2.) about the true Cause of many Ears growing out of a single Grain. If any Body would be pleased to make an Experiment with Rye and Wheat, he might try this too at the same time.





## C H A P. IV.

## Of blighted Corn.

§. 1. **I**T happens very often, that the Grains in the Ears of Wheat grow as black as Coals, and afterwards, always softer and softer, 'till they are reduced at last to a black Dust, that is as fine as Flower. We say then, the Corn is *blighted*.

§. 2. Sometimes Barley is blighted too, tho' there is no mention made of it in a great many Books about Husbandry. I once observ'd it in the Oats during my Experiments, and found that *Chomel* in his *Dictionnaire Oeconomique* under the Word *L'Avoine Sauvage*, or wild Oats, alledges the same.

§. 3. One meets with a great many Remedies against this inconveniency in Books about Husbandry. But *Florinus* in his *Skillful Country-Man*, compares it not improperly to the Toothach. No Plague has more Remedies, says he, than this, but never were Remedies less successful than here. I am much afraid, that his own Prescriptions are of the same Nature.

§. 4. The Reason of their given such improper Prescriptions against the blighting in Corn, is, that a true Definition of it has been wanting. Having no right Notion of the Thing itself, several have taken wrong Measures, searching after the Source of it.

§. 5. I find in Books of Husbandry, that some ascribe the Cause of the blighting in Corn, to a blasting Mist; others to a corrupted Seed: tho' the latter don't agree, whether the Seed is spoil'd out of the Ground, or under it, nor about the Causes in either respect.

§. 5. *Chomel*

§. 6. *Chomel* on his *Dictionnaire Oeconomique* takes the blasting Mist to be the only Cause of the blighting of Corn, and undertakes to shew the Manner of it, under the Words *Bruine* and *Froment* (tho' in both Places with the same Words) without being sure before Hand of undoubted Experience for it. He thinks, that the Mist is changed sometimes into an oily or greasy Kind of Stuff, which falling upon Grains burnt up by the Sun grows so hot, that the Grains are just as if they had been roasted.

§. 7. Who does not see that this Explication is without any Foundation, and something unintelligible? For he supposes without any Reason, that the Mist is chang'd into a greasy Kind of Stuff, such as Oil or the melted Fat of Beasts is, fit for the Roasting of some-thing, without taking any notice, whether it be his Opinion, either that the Grains retain so much heat from the Sun during the Night, that they can make a greasy Stuff's falling upon them seething hot, a Degree of Heat necessary for the Roasting of any thing, or if it is to be understood, that the cold greasy Mist grows hot upon Grains burnt up by the Sun, but cold again at Night, in such a Manner perhaps as cold *Terebinthine Oil* does, when mix'd with *Copperas*. But which soever of both Opinions, *Chomel* may chuse to be his (for a third Opinion cannot be allow'd), yet he presumes something without a Proof.

§. 8. It is never difficult to shew, that an Opinion is without Foundation: For one needs but discover the Suppositions that are destitute of Proof. But to prove incontestably, that a thing supposed without Proof, is impossible, is sometimes impracticable for want of ones sufficiently knowing the Faculties of Nature. That's the Reason, why obstinate Men, that have no taste for perspicuity or



Demonstration, very hardly abandon their Opinions. For the common Rule: *He that affirms any thing is oblig'd to prove it*, does not serve so much to make another quit his Opinion, as it does to make one careful not to admit of any Thing without a Foundation.

§. 9. I need not enlarge upon the Refutation of what has been said to maintain this false Opinion, which will prove so hereafter without that; tho' I dare say, that according to the Rules I have given c. 4. §. 7. p. 59. in my *Reflections upon the Faculties of the human Intellect*, it is impossible, that good Grains should become blasted by roasting. For a blighted Grain is soft and without any Pains rubb'd into an extraordinary fine Dust; but every thing roasted in Fat grows hard and compact. A blighted Grain hath not the least greasiness on it; but every thing that is roasted in Fat, is greasy too. A blighted Grain is full, but any thing roasted in Fat shrinks.

§. 10. Nevertheless, if any body should be desirous to know, what has occasion'd this ill-grounded Opinion of *Chomel's*, I could easily and at large shew it him by virtue of those Rules, which human Thoughts are directed by, and which will be publish'd shortly in my *Reflections upon God and the Soul of Men*. I shall tell it in a few Words. *Chomel*, who has publish'd a Book about Husbandry, in all likelihood had either read in other Books of this Kind, or had been told by Husbandmen, that Corn grew blasted, when a Mil-dew or Honey-dew falls upon it. Now he has seen that blasted Grains look black, and like unto things reduced to Dust, and therefore he concludes, that a Mil-dew burns the Good Grains of Corn. His *Dictionnaire Oeconomique* shews that he understood Kitchen-work. This  
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has put him in mind how Victuals are over-roasted and grow black in melted Butter or Fat, which made him believe again, that the Grains are roasted by a Mil-dew. And because Fat must be hot for to roast any thing in it, and knowing that every thing that is expos'd to the Sun, grows very warm, besides, that a hot Body heats all liquids it lies in; one sees without difficulty the Offspring of his other Reflections.

§. 11. One *Becker* in his *Skillful Husbandman*, and *Florinus* l. 2. (§. 3.) must have look'd upon the spoil'd Seed as a Cause of the blasting in Corn. For they think too, it may be prevented by washing the Seed in very clear River-water the Day before it is sown. It is their Opinion too, that the Seed is not spoil'd by any thing in the Earth, but rather by an impurity of its own. All those that pretend, that Wheat is blasted, when the Seed is put into a Sack that Flower has been in, must needs be of the same Opinion. On the contrary, those that mix Ashes with the Seed two Days before the sowing, in order to prevent blasting, cannot but fancy that the Seed is corrupted by something under Ground.

§. 12. All these cannot but rely upon Experience. But I have demonstrated in general in my *Reflections upon the Faculties of human Understanding*, c. 4. §. 11. p. 64. that one thing is not always the Cause of the other, tho' they follow one another; for it may happen accidentally in the above-mentioned Cases. 'Tis true indeed, that by this their Opinions appear only to be uncertain, not entirely false; but I don't pretend to any thing but to show, that they have overhastened themselves. For according to what I have said in the aforesaid *Reflections* p. 65. it was their duty to examine the Case closer. For instance, when they want to know if Wheat was



blighted by Flower (which I don't judge to be the Case) they ought to put some Grains of Seed into Flower for some Days, and so have lain 'em under the Earth separately.

§. 13. It would be a very great Improvement in Agriculture, if the Nature of this Corruption in Corn was evidently known. I fancy therefore, that a Description of my Discoveries concerning blasted Corn, cannot be disagreeable.

§. 14. I had the good Luck, when I began my Experiments with the Corn 1716, and which I made mention of heretofore, to get good and blighted Ears out of a single Grain, put into a Box filled up with Earth, that I kept all the Night in my Bedchamber, and exposed only to the open Air during the Day-time, so that neither Rain nor Dew ever touched it. The Capital Ear, that the Grain had produc'd, yielded nothing but good and sound Grains. One of the two first By-ears was good too, but the other was blasted. The sound By-ear shot out again into other good ones; but the blighted Ear brought forth other blighted ones out of the Button of the Stalk, that touched the Ground. Nay, I observed, that those Ears were blasted already which lay yet very deep in their Husks when there was nothing of any Corruption to be seen in the Leaves of the Halm, which I shall explain more particularly.

§. 15. This proves at least, that Corn is not blighted by any Sort of pernicious Dew, because my Ears were blighted without being affected by any Dew. We cannot say neither, that a Sort of Dew might fall in a Bedchamber, when the Air being contracted by the Coolness of the Night, the compressed Vapours change into Drops, because not only Experience is against it, having never met in a Morning with any Dew upon the Leaves of my Clusters

Clusters of Barley or Oats; but also because this Dew would have spoil'd the outward Sides of the Leaves, before it could injure the Ears cover'd as yet with so many Leaves, and which having no perceptible Grains, lay concealed in a little Shell. On the contrary, I have observed that, though the Leaves of the Oats became speckled, and were cover'd with a Kind of Moss under the Spots on the wrong Side, as mouldy things do, yet the Ears and Grains suffer'd nothing by it, whereas on the other Hand, the Halms that began to shoot up, faded away.

§. 16. When the blasted Ear came forth, there was a considerable Difference in the Beards, which Grains of Barley have. For as they are naturally long, straight, and green in good Ears, here they proved shorter and crooked like the wriggling of a Snake, and of a whitish Colour; which were the Circumstances that made me perceive betimes that they were blasted.

§. 17. The blasted Grains were fuller than the good ones, tho' for the most Part black and speckled, and green in but very few places. Their Figure differ remarkably from that of the good Grains. For the blasted Grain was divided into three Parts upwards to the Beard, just as if some more Grains would come out on both Sides the Top, or as if three Grains were growing one into another. The Microscope especially shew'd plainly that a blasted Grain of Barley is a three bodied monstrous Production. Because all the Grains in the blasted Ear were of the same Figure, I went into the Fields, where finding a vast many blasted Ears of Barley, I observed that the Grains were of the same Shape with my blasted Grains.

§. 18. It



§. 18. It happen'd very conveniently, that there was a large Cluster amongst the Oats, I put in the Garden, with a great many blasted Ears together with young By-Ears, Halms, and Shootings out. For this gave me an opportunity to examine the Ears as to their Degrees of Bigness, which were quite different. I discover'd not only by the Help of good Microscopes, a deform'd Figure in the Grains of young Ears, that were quite hidden, but also little black Spots here and there. This induced me to dissect a By-shoot from the blasted Barley Ear, and to pick out the Ear of it, I found particularly in the Beards something black, that filled up the whole Concavity, just as when a Pipe is choaked up. For the better Understanding of this I must observe to you, that the Beards of Barley look like a Pipe through a Microscope.

§. 19. Thus I saw evidently, that blasted Ears are nothing but extraordinary and preternatural Productions. And because fluid Matter spoil when their Current is stopt, the radical Moisture which circulates in all Plants, being hinder'd in its Circulation by an ill shap'd Figure, must corrupt.

§. 20. As to the Cause of Nature's producing monstrous Corn, I cannot determine that at present. For it is not my Custom to forge any thing in the Explication of natural Effects, but I always stop where Experience and evident Truth leaves me.

§. 21. However one may see, that there is no such thing as yet as remedying the blasting in Corn, but that more Experiments must be first made, for the finding out of the true Cause of preternatural Productions.

C H A P. V.

*Which sheweth, how this new Invention  
may improve Husbandry.*

§. 1. **A** Ccording to my Experiments of the present Year, the poorest By-ears of a Grain of Barley that yielded the least of all, had never less than 16 Grains; tho' because of the uncommon Heat of the Season, the upper Hulls were burnt up and empty. Which manifestly shews, that the Ears would have afforded a great many more Grains, had it not been for want of Nourishment.

§. 2. The most plentiful Ear in two Clusters of Barley, that is to say, of 152 Ears, yielded 32 Grains, and the next to this in a Cluster of 89 Ears, 30 Grains.

§. 3. A Grain of Barley therefore, tho' it produced but one Ear, must yield thirty-fold Fruit in a good Soil, and fine growing Weather. It must multiply sixteen-fold, if the Weather does not serve (§. 1).

§. 4. All the Roots of the Ears in a Cluster, being very near to one another (§. 17. c. 2.) the worse By-ears in a good Soil cannot have a better Situation, than the capital Ears have in a bad Soil. Therefore, because the worse By-ears have 16 Grains in bad Weather (§. 1.) and that the least fruitfulness is one half of the greatest (§. 3.) I don't think, that I am out in saying, that a Grain of Barley yielding but one Ear, must multiply sixteen-fold in a bad Soil and good Weather, and but nine-fold when the Weather is bad.

§. 5. This



§. 5, This I presume to be the Case only according to all likelihood; for I am not allowed to enquire into every thing by exact Experiments. However I fancy, that I have not reckon'd too much, nay, that I have even Experience itself on my side. For I don't doubt but that we may justly compare an Ear which shoots forth among threescore, that were grown altogether, out of a single Grain, and which is burnt up by the great Heat, to one that grew singly out of one Grain, in a bad Soil and when the Weather was bad. But my Experiments shew, that an Ear of the first Sort had nine Grains.

§. 6. If therefore all the Grains that are thrown into the Earth did come out, and if one Grain did produce but one Ear; one Bushel of Grains in a fruitful Soil and good Weather ought to yield 32, but in bad Weather 16 Bushels, and a Bushel in bad Soil and good Weather, would yield 16, but in bad Weather nine Bushels.

§. 7. I am sure that it has been reckoned a good Harvest in a fertile Country, when one Bushel of Seed has yielded nine, which should have yielded 32. (§. 6.) This proves that hardly a third Part of the Seed turns to Account, and that the other two Thirds are lost.

§. 8. Tho' a Ground is not dung'd, and the Season is so very dry, that the Grass is burnt up every where, yet one Grain that yields the least, will give 37 ripe Ears, and another that's more fruitful, 68 Ears. On the contrary there grows commonly but one Ear out of a Grain in a plentiful Crop, and good Soil that is well dung'd.

§. 9. In a dry Summer, as that I spoke of, one fruitful Grain may produce 1500 Grains, and consequently one Bushel of Barley Seed 1500 Bushels (§. 19. c. 3.) but a Grain that yields the least among  
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## *Multiplication of Corn.*

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a great many; may yield above 860 ripe Grains, and one Bushel of Barley above 800 Bushels (§. 23). But commonly one Bushel hardly gives nine (§. 7.) and therefore not the hundredth Part, nay hardly  $\frac{1}{100}$  of what it might give.

§. 10. Hereby it appears how far Husbandry might be yet improved, it being possible that the Land might yield a hundred Times as much as it does now.

§. 11. As for the Method of putting the Seed under Ground, to make such a plentiful Harvest, it may be easily discovered out of what has been said (§. 22. c. 2.) about the true Cause of the Multiplication in Corn. If a Grain is to produce many Ears, some Buttons of the Halm must needs be under Ground (§. 22.) and therefore the Seed must lie deep in the Earth, about an Inch; for then two Buttons of the capital Halm remain under Ground. And to the end, that the By-ears may have room enough to spread out, and not want Nourishment, the Grains must lie at some distance from one another.

§. 12. According to these Maxims I made a Trial last Summer with Oats and Barley, putting the Grains about the third Part of a Foot, or a little above three Inches from one another. Every Grain of Oats as well as Barley, shot forth into a whole Cluster. These were those Clusters of Barley which I have given a large Description of (§. 18. c. 3).

§. 13. It appears by this, how it comes to pass, that so much of the Seed is lost (§. 7.) why one Grain seldom gives more than one Ear (§. 9.) and why consequently the Field produces so small a Matter, when Nature might do infinitely more (§. 10). For as the Field is manured now, the

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Grains



Grains are not sown deep enough, nor far enough from one another.

§. 14. The Seed not being usually covered at all, or very little, great Part of it is carried away by Birds, which may be prevented by the Grains lying an inch under Ground, and some inches from one another; it being then Difficult to get at 'em without routing about the whole Field.

§. 15. Again, the Seed lying bare or little cover'd, and dry Weather coming in, which usually ends in a high Wind, great Part of it is blown into the high Road and troden down.

§. 16. The Seed not being well cover'd, is also more subject to other Changes of Weather, than that which lies deep under Ground. For instance, when after much Rain by which the Grains are swelled, tho' not shot out yet, cold Weather comes in, they must fret and burst. Likewise, when the Grains begin to shoot out, and the Weather proves dry soon after, the young Roots very easily dry up, and the Corn goes out. Not to speak of other Accidents.

§. 17. The Seed not lying deep may easily cause a Want of necessary Nourishment to the Corn, because the upper Part of the Ground is sooner dried up by the Sun and Wind, than the lower. For when the Weather happens to be dry, and the Corn is a shooting and blossoming, the upper Part of the Ear is stopt in its growth, and has but little Grains; to say nothing of the Grains that don't succeed, their not being solid, and consequently not so heavy as the Grains of those Ears, which have deeper Roots. (§. 25. c. 3.)

§. 18. When the Grains of Seed lie too nigh to one another, one lessens the Virtue of the other for want of necessary Nourishment. By these means the

the By-ears are missing, and the capital Halms are not so good as they would be, did they never fall Short of Nourishment. Observe, that Rain-water will not do alone to give due Nourishment, but that the saltish and sulphureous Particles of the Dung must likewise come into it.

§. 19. It is true indeed, that I have made my Experiments in the Garden and not in the Fields, and that there is a great Difference between both. For in the first Place, the garden Ground is commonly better than that of the Fields, next, the Air strikes more thorough the Field and dries it sooner up, than in a Garden; lastly, the Sun darts his Beams more and longer upon the open Field than upon Gardens, they being generally shaded by Buildings or Trees, which has this Effect, that their Soil grows not so dry as that of the Fields.

§. 20. Thus it appears, that no sure Consequence can be drawn from the Plentifulness of Corn in a Garden, to that of the Fields. For the Corn grows better in a good Soil than it does in a bad, and when the Soil is soon dried up, it wants Nourishment, which hinders the By-ears from gaining strength.

§. 21. You may observe another difference too, viz. that garden Ground is more spongy than that of the Field, which makes the By-ears take Root more easily. Besides the Roots spread wider in a spongy than in a hard Soil.

§. 22. I won't deny, but that there is something in all this, but must confess, that the Fruitfulness in the Field, may be less than in a Garden, for the afore-mentioned Reasons. But Experience itself makes me look upon it as being of little Weight against my Assertion. For looking about in the Field, I have met here and there, especially nigh



the Road, with Clusters of Ears that were grown out of a single Grain, as I could guess from the likeness they bore to my Clusters of Oats and Barley. And when I, after the Harvest was over, examin'd the Stubbles in the Field, I observed again, that Clusters of Ears had been in those Places, where the Seed had lain very thin; but that the Halms were little, and the Ears of 'em very poor, where two Grains of Seed had lain together.

§. 24. It would be worth one's while to make Experiments upon all Sorts of Ground some Years together, to observe distinctly, and with certainty, the Difference of the Faculties of Nature in different Grounds, and in different Dispositions of the Air; the Matter being of such Importance, that not only the Rents, but the intrinsic Value of Lands might be raised, in Case the Increase of Corn was carried to so high a Degree.

§. 25. But others may enter into these Occupations, that have more leisure and opportunity than I have, and that are more concerned too in the Improvement of Husbandry. I am satisfied with having proved, that infinite Ears may grow out of a single Grain, besides the new Seed it produces; provided there is no Want of those Means, by which the Growth is advanced, *viz.* of Warmth, Nourishment, and a pure Air, and with having shewn, how this is possible.

§. 26. I know very well, that those, who have a great many Fields to till, and who direct their Thoughts only upon getting of Money, will hardly like my Invention. For they don't care much for a Science, which teacheth them the Faculties of Nature, because the getting of Money is not immediately annexed to it, and they cannot see as yet, how to make any other Use of my Invention, than  
to

to make the Ground very loose, and to put the Grains of Seed separately into it, which Labour I would not advice 'em myself to go through. I should do them a more agreeable Piece of Service, if I could propose a Way to get a thousand-fold Crop by the usual Labour that's bestowed upon the the Field; and then they would not desire to know the Secret, how Nature can afford it, but be willing to submit their Reason to the Direction of their Senses.

§. 26. I don't question their being in the Right; for I should think the same, if I had no better insight into Nature, or live under their Circumstances. It would indeed be a greater Advantage to Mankind, if they could obtain such a Blessing with their usual Labour, or an equivalent trouble, than if they knew only that the faculties of Nature are infinite in the Multiplication of Corn, and in their Manner of exerting themselves.

§. 27. But after premising of this I must speak too in my own Way. I have proved, that an inexhaustible treasure lies hidden in Nature, and have shewn the Place were it is to be found, together with the Means how to get at it. So there remains nothing but to think of making those Means more feasible. No-body will dispute, but that there is now more Hopes of finding out the Treasure, than there was before any such thing was known to exist, or at least nothing was known of the Place, where it was to be search'd after.

§. 28. I don't say too much; every body will allow this, who has read all the foregoing Pages with a due Attention. It is proved by exact Experiments, that a great Number of Ears having some thousands of ripe Grains, will grow out of a single Grain of Seed, without any Preparation  
either



either of the Seed or the Field for it, tho' the Disposition of the Air be not the best (§. 16. c. 3.) I have found by reflecting on (§. 22. c. 2.) and afterwards confirmed by Experiments (§. 14. c. 3.) that a new Ear comes forth out of every Eye of the Halm before it grows hard, provided it touches the Ground. Lastly it is made evident not only from these principles (§. 11.) but also from particular Experiments, that some Eyes of the Halms and By-halms may be brought to take Root, and that therefore a single Grain gives a whole Cluster of Ears. Because it would be too troublesome as well as chargeable to put the Grains of Seed separately into the Ground (tho' it may happen to be worth while) the Case is, to think of an Alteration in the usual Instruments made Use of in Husbandry, or to make others in their Place, that are more commodious, and fit to place the Grains deep enough under the Earth, and far enough from one another.

§. 29. There is no doubt of succeeding in this, if he that undertakes it has but some Knowledge of Agriculture and Skill in Mechanicks. Nay I believe, that experienced Husbandmen will make some Use of my Invention even in their customary Way to till the Field, taking Care that the Seed is not thrown too thick, and that the Field is harrowed over better than what is commonly done. They will soon find out means to go farther, if they will but mind it. Perhaps I may gain time and opportunity myself to be useful in this Point, provided I am not prevented by another.

§. I find in the *Philosophical Transactions* N<sup>o</sup>. 60. p. 1056. that a *Spanish* Author *Don Joseph de Lucatello*, has discovered and acknowledg'd the true Defects in Husbandry, tho' not out of a true Principal. He takes for a Maxim, what the antient as well

well as the modern Husbandmen, have set a great Value upon, to wit, that Plants must be placed far enough from one another, and their Roots put deep enough into the Earth, to the end that the Roots may spread, and have no Want of Nourishment.

§. 31. Experience shows, that the Root of Corn does not spread in Breadth, and I have found in the Course of my Experiments, that the By-halms of Oats, that had shot up two Ells high, were as big again as a Corn-halm in Diameter; that an Ear of 'em held 129 double, or 258 single Grains, and one Cluster 15 perfect Halms with ripe Ears, which were for the most Part accompanied by imperfect ones, and that notwithstanding this, they had taken very little Root. The Roots of all those Ears in the Clusters had not spread two Inches, and the longest Fibers had grown downwards not above three Inches. Therefore, if it was not for the sake of the By-halms, the Grains need not be above half an Inch from one another, nor need they be deep under the Earth, because in my Experiments the By-halms, that had taken Root quite above the Ground, yielded their Fruit as well as the others.

§. 32. I don't wonder therefore, that the Maxim of *Lucatello*, who had no good Reason to conclude from gardening, that it must be so too in Agriculture, has not been minded by others. For I would not have admitted of a Consequence taken from Plants in a Garden to Corn in the Fields, seeing no sufficient Reason for it; so much the less, because according to the common Opinion, a great Distinction has been alway made betwixt Corn, and things that grow in a Garden. For other Plants grow either in breadth or in shrubs,  
but



but most People have believed hitherto, that one Grain of Corn produced but one Ear; not to mention again, that the Root of Corn does not spread itself far.

§. 33. Nevertheless, it would not be well done for the Future, quite to neglect this Observation in Matters of Agriculture, after it has been proved from a thorough Knowledge of Nature, and by infallible Experiments, that a Grain of Corn may grow up in a Shrub, if it is deep enough under the Earth, and not lies to near other Grains.

§. 34. *Lucatello* has proposed in the above-mentioned Place, an extraordinary Sort of a Plough, which besides its breaking the Ground, strews the Seed in the mean Time. He has made an Experiment with it in *Austria* in Presence of the Emperor, and effected that those Fields which yielded four or five Fold before, render'd afterwards six-fold Fruit. But this Multiplication of Corn is very inconsiderable in Comparison of what I have seen in my Experiments, and I doubt very much, whether his Plough can be of any service in Fields, that are not quite level.

§. 35. I would advise a Man, before he undertakes to find out Means of getting the Grains duly and at a convenient Distance from one another under the Earth, without great trouble and loss of Time; to make first an Experiment in a little Corner of his Fields, with a handful of Seed by putting the Grains into the Earth as we are used to do with Cucumbers or Beans, that he might experience what his Field will afford, and by observing the Root and whole Cluster, know, at what a Distance and how deep the Grains ought to be laid in his Ground.

§. 36. I

§. 36. I would have him take one Half of the Seed and let it swell in Dung-water, and so put it separately from the rest into the Earth to see if there is any other Difference besides the latter's growing quicker; it being known, that all Seed which is swelled up, grows sooner than other Seed that's quite dry.

§. 37. I have mention'd above, that I take the Soaking of the Seed to be *probably* an advantageous Dung, not having as yet been able to make the sure Experiment thereof (§. 16. c. 1.) I must therefore only show this still.

§. 38. When Dung and other before enumerated Things (§. 15. c. 11.) lie putrifying in Rain-water, the saltish and sulphurous Particles, which are required to change Water into good Sap, are communicated to the Rain-water. If the Seed lies a soaking in it, it partakes of those Particles which makes it shoot forth quickly. When the Grain is rotted, the Matter remains about the Root, and is communicated afterwards to the Rain-water, which penetrates into the Root. Accordingly there is a good deal of this Matter together in a little Place, which else would lie far and divide about the Field, and could not get in such a Quantity into the Seed, and afterwards into the Halm.

§. 39. No Body must fancy, that these, and all the foregoing Observations are the last that can be made for the Improvement of Agriculture. There are a great many Things of this Kind more, that want to be examin'd into and illustrated: These are but the Beginning of an Improvement, and a Manuduction to further Enquiries.



## C H A P. VI.

*Which sheweth the Use of this Invention in the Explication of Nature.*

§. 1. **I** Had no sooner discovered the true Cause of Multiplication in Corn, which is, that in every Eye where a Leaf sits, there is a Shooting with a Root; but I got quite different Notions of several Things from what I had before, especially relating to the Growth of Plants.

§. 2. I called to Mind not only that Eyes come forth in Trees where a Leaf is, and that it is the same with the By-stalks in other Plants (§. 20. c. 2.) but I know also, that Nature is the same in all her Operations as much as is possible. Therefore I had no Reason to doubt, but that there is an Eye in all Plants where a Leaf is, which may take Root and spring up, in case the Stalk and Leaf touch the Ground.

§. 3. And that I might be the more confirmed in my Opinion, I looked diligently about in the Gardens and Meadows, observing the Places where all Sorts of little Trees and Plants throw out their By-stalks; likewise where the Sprouts of those Plants come forth, that multiply by growing above the Earth, as *Strawberry's* and *Crowfoot* do: But I found constantly that nothing in any Place came forth but where there was a Leaf, or had been before. Nay, upon a close Examination I saw, that Nature acts after the same Manner in bulbous Plants; for Instance, in *Tulips* or *Lillies*, as I shall describe at large another time.

§. 4. I pressed also some Stalks of *Marjerom* and other Plants on a mouldy Earth, which took Root  
wherever

wherever a Leaf fat, and produced particular Sets of their Kind, that could be cut off afterwards and be transplanted.

§. 5. When I Anno 1707 inoculating young Sprigs, looked closer upon the Eyes, and considered all Parts that could be dissected by good Microscops, I observed that every Eye has its own little Root, by which it gets Nourishment. And this made me conclude, that if the Eye is to grow by Inoculating, the little Root must not be hurt.

§. 6. I did not think then but that *Malpighius* or *Grew* in their *Anatomia Plantarum* had observed, that every Eye has its particular Root, by which it receives the Nourishment coming up through the Bark. And for that Reason I mention'd it as a Thing commonly known in my Dissertation upon the hard Frost 1709. Sect. I. and §. 25. p. 26. giving a Description of the little Root in those Eyes that were not frozen, but continued to spring up. But looking now for it in the aforesaid Books, I find nothing of the Matter, which makes me believe, that they hurt the Eyes, when they examin'd the Structure of 'em.

§. 7. Because the Eyes in Trees, and other Plants, are nothing but a Button with a Root; and because, according to my Experiments relating to Corn (§. 2. c. 3.) the Roots grow forth, and then the Eye shoots out when that Part of the Plant wherein it lies hid is under the Earth, or touches, at least, a spongy Earth: This fully instructed me in the Nature of pruning in Gardening; by which some Trees and Plants, as for Example, *Lemon-Trees*, *Vine-Stocks*, *Gilliflowers* are propagated. viz. The Roots of the Eyes spring out in the Earth, and by this give more Nourishment to the Eye, so that what is little in the Button, may grow big.



§. 8. It will be made evident by and by, why a whole Tree, or other Plant of the same Kind, with that which the Eye belongs to, is obtained by the aforesaid Way, after I shall have made it appear, how out of a single Grain of Seed a whole Tree or other Plant of a certain Kind may grow.

§. 9. But before I do this, I must answer a plausible Objection that might be made against what is said about pruning (§. 7.) For it seems to follow from thence, that all Plants can be pruned whenever the Part of the Stalk, where a Leaf Sits, can be brought under or at least to the Earth; because, in my Opinion, in that very Place, in all Plants, there is a Shooting; that is, an Eye with a little Root, which is nothing else but a little Plant thoroughly formed. But Experience teaches that it is not generally to be done.

§. 10. This Objection is actually solved already above. For, reflecting (§. 3. c. 3.) upon the Experiments I was to make, to make good the true Reason (§. 13. sq. c. 2.) of many Ears growing out of a single Grain, found out by way of Meditation; I then observed that the Stalks ought to be pruned before the Buttons grow hard: And there describing also, how I proceeded in my Experiments, and what Success I had, I not only (§. 8. c. 3.) told the Reader, that I laid Earth round about the Halms, their lower Buttons being yet quite green and soft; but also that the Buttons bursted where the Roots grew forth. Wherever therefore the Bark is hard, and the Root cannot come thro', the Pruning too becomes impracticable, except you would assist Nature by Art, and make your self an Opening through which the Root might come forth.

§. 11. Experience confirms what I have said. For examining into the Structure of Trees and  
Plants

Plants that can be pruned; and of others, where Pruning won't succeed, we see, that the first have a Bark which easily bursts, but that the latter have a Bark, which, with greater difficulty is forc'd away and split. For instance, Vines are easily pruned, but then the Bark of them is not only very thin, but breaks also in an Instant.

§. 12. Mr. *Agricola*, a Physician at *Ratisbon*, who is pleas'd to spend his By-hours in useful Enquiries into Nature, and who has offer'd several Projects to make a general Application of these Methods of Multiplicating of Trees that have not been used hitherto but in some sorts of Trees, has shewn also how to prune Trees of all Sorts to the best Advantage in the first Part of his *Essay on the universal Multiplication of Trees, Plants, and Flowers*, §. 160. *Sq.*

§. 13 I leave it to others to judge, how much this Project is to be rely'd upon, into which, as the Author says, p. 143, he fell by Chance, and when he had no Notion of the Art of expelling Roots. For he not only begs of the Reader, in the Preface to the first Part, tha the would publish nothing against his Projects if they should not prove every where to answer his Expectation, he thinking himself able and sincere enough to reform or refuse them in the aforesaid Case; but he has actually said something against it in the second Part of his *Essays*, p. 16, with an Openness becoming the Learned.

§. 14 I have taken Notice of this Method of Mr. *Agricola's* to bring forth Roots out of Trees in general, with no other View, but that an Objection might be drawn from it against my Explication of Pruning, (§. 7.) which I must solve to make it free from all Manner of Doubt.



§. 15. According to my Explication, those Roots which are produced by pruning, are the little Roots that give Nourishment to the Eyes (§. 10. c. 6.) On the contrary Mr. *Agricola* has observed that a Sap came out of the Incision; and that after it was settled the Roots grew out of it. It seems by this, that Experience contradicts my Notions which are only founded upon Reasoning.

§. 16. I find indeed that Mr. *Agricola* says, p. 160, that such a Sap, by which Nature forms the Roots, is to be met with in general in all Trees. But notwithstanding I read several Times over this, and the following, I never could convince my self that Roots were grown in any other Place but that of the Eyes. However, if it should happen that Roots should come forth elsewhere on a pruned Bough, I am assured that these are none but Roots of Eyes that lie concealed in that Part of the Tree. For I know very well from other Principles, that nothing that is *organick* can be generated by an *in-organick* Matter.

§. 17. It is the same Case with cutting off little Boughs, and putting them under ground to take Root there, as it is with Pruning. It may be done with such Plants as don't wither very soon, and have a soft Bark besides. The Bark of 'em must be soft, for else the little Roots cannot come through; but they must neither decay in a little Time, because they receive very little Moisture out of the Ground all the Time they have stood without taking Root. *Rosemary*, which is propagated after this Manner, may explain this.

§. 18. In treating the present Subject I have had an Opportunity of instructing my self better in the Nature of Seeds. The Grain of Seed contains in it, as every Body knows, the Matter that gives the

the first Nourishment to the Root and the Blossom. The Blossom consists of a little Root, two Leaves in the Shape of a Heart, and one Eye. I am the First that has discovered a little Root in the Blossom as far as I know, because I don't remember any Book printed before my Dissertation *upon the hard Frost*, wherein it is taken Notice of. Most People have believed hitherto, that that Part of the Button or Blossom which appears betwixt the Leaf in the Shape of a Heart contains the whole Tree in it self. But my Invention gave me an Opportunity to observe, that it is nothing but one Eye, in which as much is formed in little, as will grow out of one Eye. The Heart-leaves serve, in my Opinion, to bring the Eye to that Degree of Maturity which it has Occasion for to shoot out.

§. 19. The Reason that induc'd me to call that Part of the Eye which lies concealed within the Tree, a Root, are these: First, this interior and lower Part of the Eye has the same Figure with the lower Part of the Button in the Seed, out of which the Root is formed, even when they are examined by a Microscope, that represents very distinctly every Thing. Secondly, it is known, that if in inoculating a yong Sprig, you hurt or break the intrinsic Part of the Eye, its Growth is stopt, and the little Seed does not grow forth, if the lower Part of the Button is broke off or any ways damaged. Hence I gather'd, that this lower Part of the Eye is the Part by which it must receive Nourishment if it is to spring up and grow, consequently that it is a Root. I was confirmed in this Opinion upon Occasion of the hard Frost 1709, where I saw (as is mentioned §. 6. c. 6.) that those Eyes sprung up, whose intrinsic Part was not damag'd  
by



by the Frost, tho' the Wood and Bark had suffer'd a great deal.

§. 20. I admit of no more than one Eye in the Button betwixt the Leaf, in the Shape of a Heart, because no more grows out of it, but what one Eye can contain. For, all the rest that comes forth, grows out of new Eyes that settle and are generated from the Pith. I leave it to another Opportunity to enquire, how they come into the Pith, because it would enlarge this Paper too much if I was to treat fundamentally of it. However, this being the Way I like to proceed in, I pass by several Things that I could say of the Structure of this Eye in different Plants.

§. 21. I ascribe to the Heart-leaves in the Bud of the Seed, the Preparation of the necessary Nourishment, by which the Eye is brought to Maturity, because I have observed that these Eyes begins first to grow when the Heart-leaves come to Perfection, and that these fade away as soon as the other has finish'd its growth. For this Reason I doubt not but that, if the Heart-leaf was taken away, while the Seed is coming up, the Eye would be either quite spoiled, or at least come out very slowly. And by this Experiment the Justness of my Opinion is incontestibly proved. Here I might observe also a great Likeness that lies hidden under the aparent Unlikeness in several Seeds, if this was a proper Place.


§. 22. It is Time now to show, how out of one Grain of Seed a Plant, or for Instance, out of one Kernel a Tree grows, which is the most perfect Sort of Plants. The Kernel contains some little Particles, by which the Water that makes it swell up, is changed into a proper Nourishment. This nourishing Sap runs into the Bud and enlarges the  
Root

Root and Heart-leaves, and then the Seed shoots out. The Root under the Ground communicates the Sap to the Heart-leaves in which it is entirely prepared for the Nourishment of the Eye. After this is become ripe by these Means, it spreads out, and by the Sap that is conveyed from the Root into the little Stem, the Particles of it are extended and made larger. Thus much grows immediately out of the Seed, which, to sum it up, is nothing else but the enlarging the Bud in the Seed.

§. 23. Therefore, because in all Places where a Leaf sits, an Eye is concealed in the Pith, which has a perfect Resemblance to the Bud of the Seed (§. 7. c. 6.) and which growing forth is brought to its Maturity by the Leaves, just as the Eye of the Bud by the Heart-leaves; there may consequently grow afterwards out of every Eye as much as is grown from the Seed, viz. a young Twig, which must bring forth new Eyes again, like the first, and so farther.

§. 24. There is no doubt but that the Eyes which the young Twig brings forth, are generated in the same Manner as those of the Seed. But it shall be my Business another Time to know how they come into the Pith.

§. 25. As there is no more than one Eye in the Seed, out of which the whole Tree is formed, we see the Reason why by inoculating a Tree can be caused to grow out of a single Eye, and that it is no wonder that the largest Trees in Woods are generated out of the smallest Grains of Seed.

§. 26. And whereas one Eye is sufficient to a whole Tree, it is much less a Wonder to rear up  

a whole



a whole Tree by grafting a Twig that has many Eyes.

§ 27. Lastly, as the Roots have a Pith like the Twigs, and as there are Eyes in the Pith, it is no more a Wonder, than in Case the Roots has Sap enough, Eyes come forth from it, and grow out in By-shoots. Thus we see the Reason why some Trees and Plants can be propagated by parting the Root or Shoot, which is immediately out of the Seed.

§ 28. Any Body may see now, that the having found out the true Cause of Multiplication in Corn, gives a general Light into the Production of Plants and Trees. I am in Hopes of explaining this further upon another Occasion.

§ 29. For the present I observe only this more: By the Help of the aforesaid Invention one sees the Use of every Part of the Tree, and in general of any Plant, which has not been reflected upon before as far as I know, viz. the Pith brings forth the Eyes, and for that Reason it becomes hard Wood in Trees that blossom no more. But by Microscopes we know that there is much on the Inside of an old Bark that resembles a Pith; and therefore it is possible that a Tree which has lost its fluid Pith can nevertheless begin to blossom again out of the Bark. The Bark in particular prepares the Nourishment and brings it to the Eyes and Leaves; and the Leaves must bring the Eyes to their Maturity.







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